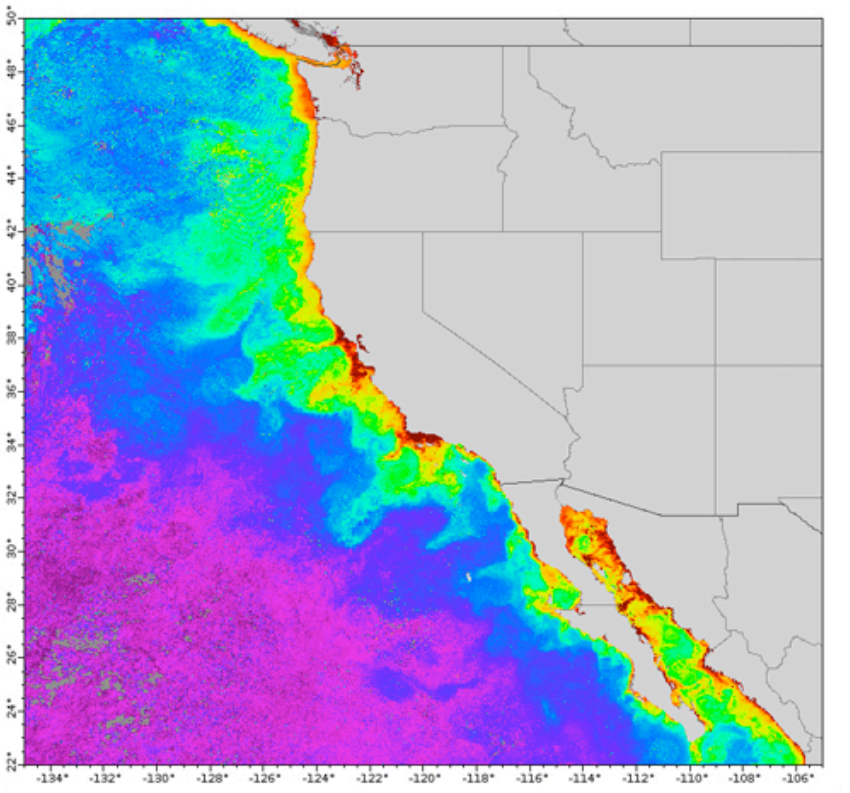
NOAA Ocean Satellite Data Course
Aug 22-24, 2006



Cooperative Institute for Oceanographic Satellite Studies (CIOSS)
College of Oceanic and Atmospheric Sciences (COAS)
Oregon State University (OSU), Corvallis, OR

http://www.pfeg.noaa.gov/events/workshops/NOAASatCourse2006/

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Instructors

Dudley Chelton	OSU/COAS
Dave Foley	JIMAR (NOAA/NMFS/SWFSC)
Carlos Rivero	NOAA/NMFS/SEFSC
Luke Spence	NOAA/NMFS/SWFSC
Ted Strub	OSU/COAS
Peter Strutton	OSU/COAS
Cara Wilson	NOAA/NMFS/SWFSC

Participants

1. Scott Benson	NMFS/SWFSC/PRD
2. Eric Bjorkstedt	NMFS/SWFSC/FED
3. Eric Breuer	NMFS/S&T
4. Jon Brodziak	NMFS/PIFSC
5. Russell Brown	NMFS/NEFSC
6. Michael Cameron	NMFS/AFSC/NMML
7. Sophie DeBeukelaer	NOS/NMSP- Monterey Bay
8. Scott Donahue	NOS/NMSP- Florida Keys
9. Michael Goebel	NMFS/SWFSC/AERD
10. David Hanisko	NMFS/SEFSC
11. Brad Hanson	NMFS/NWFSC/CB
12. Alan Haynie	NMFS/AFSC/REFM
13. Joseph Kane	NMFS/NEFSC
14. Kaylene Keller	NOS/NW Hawaiian Islands Marine National Monument
15. Suzanne Kohin	NMFS/SWFSC/FRD
16. Stan Kotwicki	NMFS/AFSC/RACE
17. Patty Miller	NOS/NMSP- Hawaiian Humpback
18. Cheryl Morgan	NMFS/NWFSC/FED
19. Scott Nichols	NMFS/SEFSC
20. Robert O'Conner	NMFS/PIRO
21. Eric Orbesen	NMFS/SEFSC
22. Michael Parke	NMFS/PIFSC/CRED
23. Denise Parker	NMFS/PIFSC
24. Tim Reed	NOS/NMSP- Gulf of the Farallones
25. Anne Richards	NMFS/NEFSC/PDB
26. Michael Schirripa	NMFS/NWFSC/FRAM
27. Kalei Shotwell	NMFS/AFSC/ABL
28. Pamela van der Leeden	NOS/NMSP- Cordell Banks
29. Carol Fairfield Walsh	NMFS/SEFSC/PRBD
30. Larry Zuckerman	NMFS/NWRO

NMFS	National Marine Fisheries Service
NOS	National Ocean Service
NMSP	National Marine Sanctuary Program
AFSC	Alaska Fisheries Science Center
NEFSC	Northeast Fisheries Science Center
NWFSC	Northwest Fisheries Science Center
PIFSC	Pacific Islands Fisheries Science Center
SEFSC	Southeast Fisheries Science Center
SWFSC	Southwest Fisheries Science Center
S&T	Science & Technology

Background

The continuity, global coverage, and high temporal and spatial resolution of satellite data make it an important tool for monitoring and characterizing marine ecosystems. Most of the spatial features that are important to marine ecosystems, i.e. ocean fronts, eddies, convergence zones, and river plumes, cannot be adequately resolved without satellite data. These features are important congregation points for fish and other living marine resources, and therefore the ability to observe and monitor them is important for NOAA's long-term strategic goal to protect, restore, and manage coastal and ocean resources through an ecosystem approach to management. Satellite data is also crucial for resolving the timing of processes such as upwelling, harmful algal blooms (HABs), seasonal transitions and El Niño events. The ability to monitor these processes is important as changes in the timing of seasonal transitions and upwelling can alter the available food supply at the base of the marine food chain, which can have consequences throughout the entire ecosystem.

However satellite data has generally been underutilized within NMFS and NOS. One reason for this is the difficulty in accessing and manipulating the large depository of existing satellite data. This course was developed to address this issue by providing an overview of the types of environmental satellite data available, where and how to access the data, and methods of working with the data. Better integration of satellite data into NOAA's approaches to ecosystem management will enhance the strategic use of information technology, which is a NOAA priority.

Participants

The interest expressed in this class was much bigger that we could accommodate. 62 applications were received, however the class was limited to 30 participants, due to the size of the computer classroom at OSU. The 30 participants were selected based on the scientific merits of the project they proposed to work on, and to achieve an equitable geographic distribution of participants: 6 were selected from NOS, and 4 from each of the six NMFS regions. The course was open to both federal employees and contractors of NOS and NMFS, however the funding only covered the travel costs of federal employees. Most participants were federal employees; there were 6 contractors.

Course Description & Agenda

Lectures

The first half-day of the course had lectures of the fundamentals of oceanographic remote sensing, which were given by professors associated with CIOSS at COAS/OSU.

Course Introduction	Cara Wilson
Ocean Remote Sensing Introduction and IR	Ted Strub
Ocean Color Remote Sensing	Peter Strutton
Microwave Remote Sensing of the Ocean	Dudley Chelton

All participants also received a copy of the textbook "An Introduction to Ocean Remote Sensing" by Martin Seelye. The presentations given during the course are available on the course webpage at: http://www.pfeg.noaa.gov/events/workshops/NOAASatCourse2006/

Laboratory
The remainder of the course was spent in the computer classroom focusing on the applications of satellite data within Fisheries and Marine Sanctuaries. This section started out with presentations giving overviews of the different applications of satellite data within fisheries and marine sanctuaries (Wilson), and of the different tools for data access and manipulation, focusing on ArcGIS and OPenDAP via Matlab (Foley).

Recognizing that many managers and researchers within both NMFS and NOS use ArcGIS software, one of the focuses of the course was how to import and use satellite data in ArcGIS, with specific demonstrations worked though during the class (Spence and Rivero). However importing satellite data into ArcGIS can be cumbersome, and the software does not deal very well with long timeseries of data that are needed for many fisheries and ecosystem applications. For example, a common application in fisheries involves matching satellite data with the tracklines of either tagged species or cruises, to place the in situ data in a larger environmental context. However the process of downloading large volumes of satellite data, and subsequently extracting hundreds of datapoints at varying locations and times, would be extremely difficult to do in ArcGIS, particularly if one is unaccustomed to working with satellite data. Therefore another focus of the course was on using OPenDAP, a data delivery mechanism that allows remotely stored data to be accessed directly from different software applications (http://www.opendap.org). The use of OPenDAP was demonstrated during the course using Matlab software. Specifically a custom-made Matlab application (created in-house at SWFSC/ERD by Foley) was presented which extracts satellite data along a user specified series of locations and times, such as those logged by a tagged specie. The Matlab routines developed for use in the course will be posted on the course website.

Projects

Participants were expected to come to the class with a project using satellite data to work on during the course. There was a wide variety of different projects, including:

- Analyze connections between onshore and offshore water quality in marine sanctuaries
- Characterize and monitor conditions in the newly established Northwestern Hawaiian Islands Marine National Monument
- Identify convergence zones for use in modeling oil spills in marine sanctuaries
- Integrate satellite data into marine education curriculum
- Place the behaviors of tagged species (turtles, seals, albacore etc.) into an ecological context by correlating their movements with oceanographic conditions
- Analyze how different oceanographic conditions affect fisher location choice
- Evaluate ability of satellite ocean color products to measure in situ light intensity, which affects the distribution of some species of fish
- Incorporate environmental information from satellite data into stock assessment models to improve estimates in recruitment, catchability etc.
- Optimize current and future fisheries and ecosystem surveying programs
- Examine match-mismatch hypothesis in shrimp hatch by determining timing of spring bloom with satellite ocean color data
- Analyze ocean conditions to help predict returns of steelhead and salmon
- Better identify and classify Essential Fish Habitat (EFH)

Feedback

Participants were strongly encouraged to provide feedback on the effectiveness and usefulness of the course. 21 (65%) evaluation forms were received back. In general participants were extremely enthusiastic about the course, and recommended that it be offered again. Suggested improvements included:

- Provide written handouts on procedures covered in laboratory component
- Provide a summary of existing satellite datasets, their temporal and spatial coverage, where to find them and other basic information
- Provide a comprehensive list of when to use what type of data
- Better handling of the different skill levels of participants
- Have a sign-up sheet for 1-on-1 time with instructors
- Do personal introductions on the first day of the course
- Develop list-server where participants can exchange problems, issues, ideas etc.

Follow-up activities

A recurrent comment from the evaluation forms (see above) expressed a need for a summary of existing satellite datasets with some basic information. In response to this feedback a "Satellite Data Primer" was written, which is posted on the course website. Written documentation on some of the computer demonstrations given during the course are also posted on the website.

We hope to convene a special session on the usages and utility of satellite data in marine management at the next AGU/ASLO Ocean Sciences meeting in Orlando, FL March 2-7 2008. We'll strongly encourage participants to present the results of projects initiated during this course at this session.

Funding

Funding for the course was provided by NOAA's Research and Operations (R&O) project, led by Stan Wilson (NESDIS), which covered the travel costs of all federal employees who participated in the course (including the instructors). Of the 16 federal employees who completed an evaluation form, 12 (75%) indicated they would not have been able to take the class if their travel costs had not been covered. The R&O funding also covered the purchase of a textbook for all participants. CIOSS paid for the cost associated with using the computer classroom.

Future Courses

Currently we plan to hold a second, identical course the week of March 26-30, 2007, to coincide with OSU's spring break since the course must be scheduled when classes are not in session at OSU. It is doubtful that we will have funding to cover participant's travel, as we did for the first course. We will encourage potential participants to use the funds set aside at each laboratory for training purposes. However, if not enough people can come up with their own travel funding to form a critical mass, we will have to cancel the class.

Additional Information

For additional information contact Cara Wilson at cara.wilson@noaa.gov or (831) 648-5337.